REMARKS

It is noted with appreciation that the drawings submitted with the previous Amendment have been accepted, and objections to the application raised in the original Office Action of April 5, 2006 have been overcome.

Claims 1-4, 8, 10, 11, 13, and 14 were again rejected under 35 USC 102 as anticipated by Bowles, 5,155,289. Claims 5, 6, 12, and 15-20 were again rejected for obviousness under 35 USC 103 over Bowles in view of Gold, 5,953,224. Claims 7 and 21 were rejected for obviousness under 35USC 103 over Bowles in view of Vercelloti, 5,774,000.

With regard to Figs. 8 and 9, it is inherent that when the electrical source is connected, there will be no line current if both parallel switching modules are in the open off state. When there is line current, the line current may flow solely through the first switching module, or the line current may flow solely through the second switching module, or the line current may be shared by the switching modules simultaneously. Where the line current actually flows depends on the open /closed states of the respective switching modules and/or the relative resistances of the two paths.

Claims 11 and 14 as originally presented described the controlled sequences of the two modules for <u>turning off</u> a closed hybrid switch that is flowing line current in the conduction mode. These claims are amended herein to describe the control sequences for <u>initiating</u> current flow in a hybrid switch of the invention that is open circuited in both parallel paths at the outset. Additionally, the sequences for <u>turning off</u> the hybrid switch from its conduction mode to its fully open non-conducting (off) state are again included in both claims 11 and 14. A complete on-off cycle is now defined in the claims.
In summary, what the control circuit actually does in the present invention is defined in amended claims 11 and 14 with reliance on timing diagrams of Figure 9. Accordingly new matter was not added by the present claim amendments.
The rejections of claims under 35 USC 102 and 103 are respectfully traversed.

As defined in claim 1, in the present invention the first switching module is reserved for switching and by design generates substantially all of the switching losses. Conversely, the second switching module is reserved for conduction and by design generates substantially all of the conduction losses. This separation of losses is key to the present invention in reducing the overall system losses. The minimization of losses in both arms in the same circuit simultaneously has not been done in the prior art. Separating the switching and conducting losses into separate arms of the hybrid switch allows the circuit designer to minimize each loss independently.

As to the rejection of claim 1 as anticipated by the US patent of Bowles (5,155,289), Bowles does teach in his Figures 6 and 7B a hybrid switch comprising: a first switch module (607B, 611B) for switching voltages and currents and incurring switching losses (as taught in column 8 lines 20-29 and column 8, line 64 through column 9, line 32); and a second switching module (606B, 609B) for conducting current and incurring conduction losses (as taught in column 8 lines 20-29 and column 8, line 64 through column 9, line 32). However, unlike the current patent of amended claim 1, the second switch module in Bowles (the conduction switches 606B, 609B) also incurs substantial switching losses (as well as its conduction losses).

Following Bowles in a turn-on sequence described in Bowles figure 7C, the control signals A and B which control the second switch module (the conduction switches 606B, 609B) are turned on before the first switch module (607B, 611B) as taught in Bowles column 9 line 17. This generates a switching loss in the second (conduction) module because a substantial voltage (100 volts, the source voltage 602B of figure 7B, and column 9,line 47) exists across the switch before turn-on. The switching loss in the second module is smaller than that borne later in the sequence by the first module. This lower loss occurs because the second switch sees a lower voltage and an inductor in series in this specific application. Bowles teaches the second module switches at a low voltage but the first module switches at a high voltage (800 volts column 10, line 4) .

In high frequency applications and for general applications, this added switching loss in the conduction arm can be significant.

To the contrary, in the present patent, the switching module absorbs substantially all the switching losses and the conduction modules switch at voltages comparable to the on-state voltage of the switching module, which is a only few volts. The present invention does not depend on the load in series with the source being an inductor in the circuit to lower the switching losses at turn-on as does Bowles.

Stated in other words, although Bowles has two current paths one for lowering conduction losses and one for switching, the paths <u>do not</u> segregate switching losses from conduction losses as is the case for the present invention. The path used by Bowles for lowering conduction losses is also used for switching high voltages (100 volts) and incurs substantial switching losses especially at high frequencies. Not all switching losses are contained in the "switching path" of Bowles by virtue of his control methodology. The Bowles conduction (MOSFET) path is subject to high switching losses causing the MOSFET to heat up more than it would in the context of the present invention. During charging Bowles turns on the MOSFET **conducting** arm first and <u>not</u> the switching arm as is the case in the present invention.

Bowles <u>makes no effort</u> to remove switching losses from the conduction arm, relying on the presence of the series inductor. He is focused on using low voltage, low conduction loss components in the charging section, and high voltage switching devices in the second arm rated at low average powers. In the process he achieves a boost converter, amplifying the voltage by using the combination of low voltage and high voltage parts and at the same time reducing the conduction losses in the overall system. He does not segregate the losses as in the present invention. The present invention applies to the more generic case and provides an opportunity to optimize <u>the overall</u> system losses, especially in cryogenic hybrid switches.

For these reasons, namely, rigorous loss separation and optimized reduction of both loss types, it is respectfully submitted that claim 1 is not anticipated (nor suggested) by Bowles and the rejection under 35USC 102 is inappropriate in this case.

It is respectfully submitted that the remaining claims are also allowable, if only for their dependencies on claim 1. However, it is respectfully believed that the 103 rejections are also inappropriate in that each relies on Bowles and additionally Gold and Vercelloti respectively. None of the three references is concerned with or suggests optimization of switching losses in a particular switching module, and optimization of conduction losses in another parallel switching module, each module specifically constructed to reduce its type of loss for any load impedance.

An earnest effort has been made to be fully responsive to the Examiner's objections. In view of the above amendments and remarks, it is believed that claim 1 and all claims dependent therefrom are in condition for allowance as amended. This amendment is not believed to add new matter, raise new issues, or require additional searching on the part of the Examiner. Entry of the Amendment and allowance of this case are earnestly solicited. However, if for any reason the Examiner should consider this application not to be in condition for allowance, he is respectfully requested to telephone the undersigned attorney at the number listed below prior to issuing a further Action.

A fee for a one month time extension is enclosed.

Respectfully submitted,

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